

A Novel DNA Immobilization Technique to Fabricate DNA Chips

J.Z. Zhou, L.L. Wu, L.Q. Dong, Z.Y. Lin, J.W. Yan, Z.H. Lin

State key Laboratory for Physical Chemistry of Solid Surface, Department of Chemistry, Institute of Physical Chemistry, Xiamen University, Xiamen 361005, CHINA

With the revolutionary developments of Human Genome Project, DNA probe-based biosensors or biochips have been a highlight of genome research field. The immobilization of DNA on surface is of great interest and important in DNA sensors or chips and various other applications. More and more studies of DNA using self-assembly technique were reported.

In this work, cationic polyelectrolyte, poly(diallyldimethylammonium)(PDDA) was used to facilitate DNA immobilization on the gold surface. It is conceivable that immobilization of the negatively charged DNA onto ordered positively charged PDDA cations adlayer on the gold surface is greatly facilitated by strong electrostatic interactions. Fig. 1 a, b are STM images of self-assembling PDDA films. STM images of the PDDA films reveal a two-dimensional close-packed ordered lines array (1~2nm in width) structure of assembled PDDA. As shown in Fig. 1c, the subsequently absorbed DNA strands are immobilized along the direction of PDDA “lines array” which are also ordered to some extent, and some hanging and winding segments of DNA strands form the some convexity on STM images which is consistent with the STM images of adsorbed dsDNA on highly ordered pyrolytic graphite[1]. Fig. 1d shows several strands of assembled dsDNA while some segments of adjacent strands twist together.

The results of STM imaging suggest a possible approach using this method to achieve nano-scaled ordered DNA array, which has potential to be a considerably simple and low-cost method to construct ultra-high throughput DNA chips.

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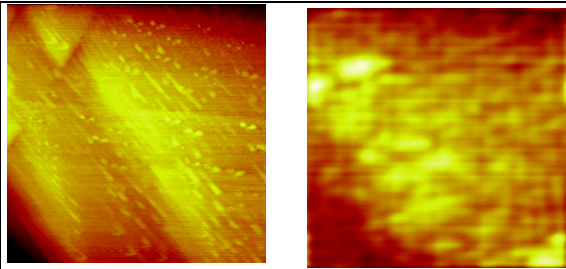


Fig. 1c STM images of DNA/PDDA self-assembling films on Au(111), 200×200nm, Current mode, Z-range:1.57nm, setpoint:0.20nA, V_{bias}:0.28V

Fig. 1d STM images of DNA/PDDA self-assembling films on Au(111), 20×20nm, Current Mode, Z-range:0.38nA, setpoint:0.76nA, V_{bias}:0.32V

Reference:
[1] L.L. Wu, J.Z. Zhou, J. Luo, Z.H. Lin, *Electrochimica Acta*, 45 (2000) 2923

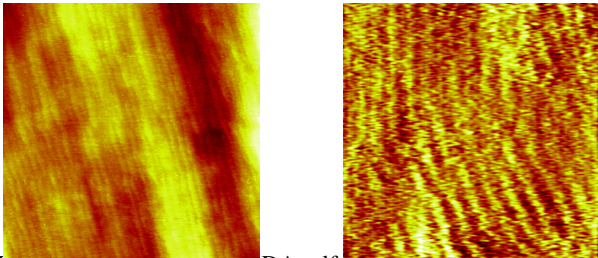


Fig. 1a STM images of PDDA self-assembling films on Au(111), 100×100nm, Current mode, Z-range:0.58nA, setpoint:0.88nA, V_{bias}:0.20V

Fig. 1b STM images of PDDA self-assembling films on Au(111), 20×20nm, Current mode, Z-range:0.61nA, setpoint:0.60nA, V_{bias}:0.10V